Coordination and Data Management of the International Arctic Buoy Programme (IABP)

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LONG-TERM GOALS

The long-term goal of the International Arctic Buoy Programme is to maintain a research quality database of direct measurements and analyzed fields of surface air temperature (SAT), sea level pressure (SLP), ice motion and other geophysical quantities in the Arctic Basin using drifting buoys.

OBJECTIVES

The program objectives are (1) to coordinate resources to maintain a network of drifting buoys in the Arctic Basin that measure SLP, SAT and other geophysical quantities; (2) to maintain a research quality database of these observations; and (3) to study possible improvements in the analyzed geophysical fields. The data collected meet meteorological, climatological, and oceanographic requirements for both research and operational needs. Figure 1 shows the positions of buoys in October 1998, with the sea ice concentration map obtained from the National Center for Environmental Projection underlayed.

APPROACH

Coordination of the IABP involves distribution of information, resource management, and meeting planning. Information is primarily distributed via monthly buoy position charts and by one-to-one correspondence. General information is available in our brochure and from the IABP web site. Resource management is focused on matching buoy hardware and deployment opportunities to the requirements of maintaining the buoy network.

Data management consists of analyzing the available buoy data and producing data sets of ice motion, SLP, and SAT for research use. These data sets are described in annual reports, and are archived at the World Data Center. Primary distribution of the data sets is through the Polar Science Center (PSC) via anonymous ftp. These data and other research products of the IABP are available on the World Wide Web at http://iabp.apl.washington.edu/.

WORK COMPLETED

Our recent efforts to improve the IABP databases have resulted producing a new SAT analysis which combines data from the buoys with data from land stations using the objective analysis procedure, optimal interpolation. This new SAT analysis is documented in two papers, which have been submitted to the Journal of Climate (Rigor, et al 1998, and Rigor 1998), and the data has been incorporated into a Global SAT climatology (Jones, et al 1998).

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We hosted the Eighth Annual Meeting of the IABP here in Seattle, as well as two mini-conferences associated with the IABP, one commemorating the first 20 years of the program, the second was a workshop on the use of sea ice charts in operations and research.

RESULTS

The correlation length scale between observations of surface air temperature have been shown to vary seasonally as well as by location. The seasonal scales are shorter than the annual scales, especially during summer when the inhomogeneity of the Arctic landscape is most apparent (Rigor, et al 1998). These statistics have been applied to the analysis of a new SAT dataset.

Using this SAT dataset, variations in SAT were studied. We show that there was a 3°C/decade warming over the eastern Arctic Ocean as well as a lengthening of the melt season of sea ice. We show that these variations in SAT are related to the Arctic Oscillation (Thompson and Wallace, 1998), which accounts for more than 50% of the trends in SAT over much of the Arctic region.

IMPACT/APPLICATIONS

The buoy data meet meteorological, climatological and oceanographic requirements for both research and operational components internationally, and thus the buoy program has gained widespread support. High latitude countries use the data to forecast weather. The data are essential in monitoring climate, assessing the environment, validating model simulations of atmospheric temperature and pressure and ice drift. Specifically, operational weather prediction programs in the circumpolar countries benefit from the surface pressure and temperature data that the network provides. The archived data have been used to study ice motion and dynamics in the Basin. The pressure data are used to estimate the mean surface wind, which can drive sea ice models, and for input into climate change studies.

Recent research using the IABP databases includes back and forward trajectory analysis to study the origins and fate of samples taken from the sea ice. Given the current location of a piece of ice, using the IABP databases, we can trace its probable history, and predict its future deposition. Results of these studies have been published or presented in collaboration with various colleagues.

The data from the IABP has been instrumental in documenting climate change in the Arctic. Results on decadal scale variability show the Arctic Basin to be a center for extraordinarily large change. Using IABP data, Walsh et al (1996) compared two eight-year records, 1979-86 and 1989-94, and found a 4 mb difference between the means of these two periods. Rigor (1998) studied the inter-annual trends in SAT and the length of the melt season over the Arctic Ocean. He found a 3°C/decade warming and showed that these variations are related to the Arctic Oscillation and the changes in circulation. Figure 2, shows the trends in SAT during winter and the fraction of these trends related to the Arctic Oscillation.

TRANSITIONS

Changes of in SLP and SAT have been shown by Walsh et al (1996) and Rigor (1998). A study of the corresponding changes in sea ice motion is in order.

RELATED PROJECTS

None.

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Thompson, D. W. J., and J. M. Wallace, The Arctic Oscillation signature in the wintertime geopotential height and temperature fields, *Geophys. Res. Let., 25*(9), pp. 1297-1300, 1998.

Walsh, J. E., W. L. Chapman, and T. L. Shy, Recent Decrease of Sea Level Pressure in the Central Arctic, *J. Climate, 9*.(2), pp. 480-485, February 1996.

PUBLICATIONS

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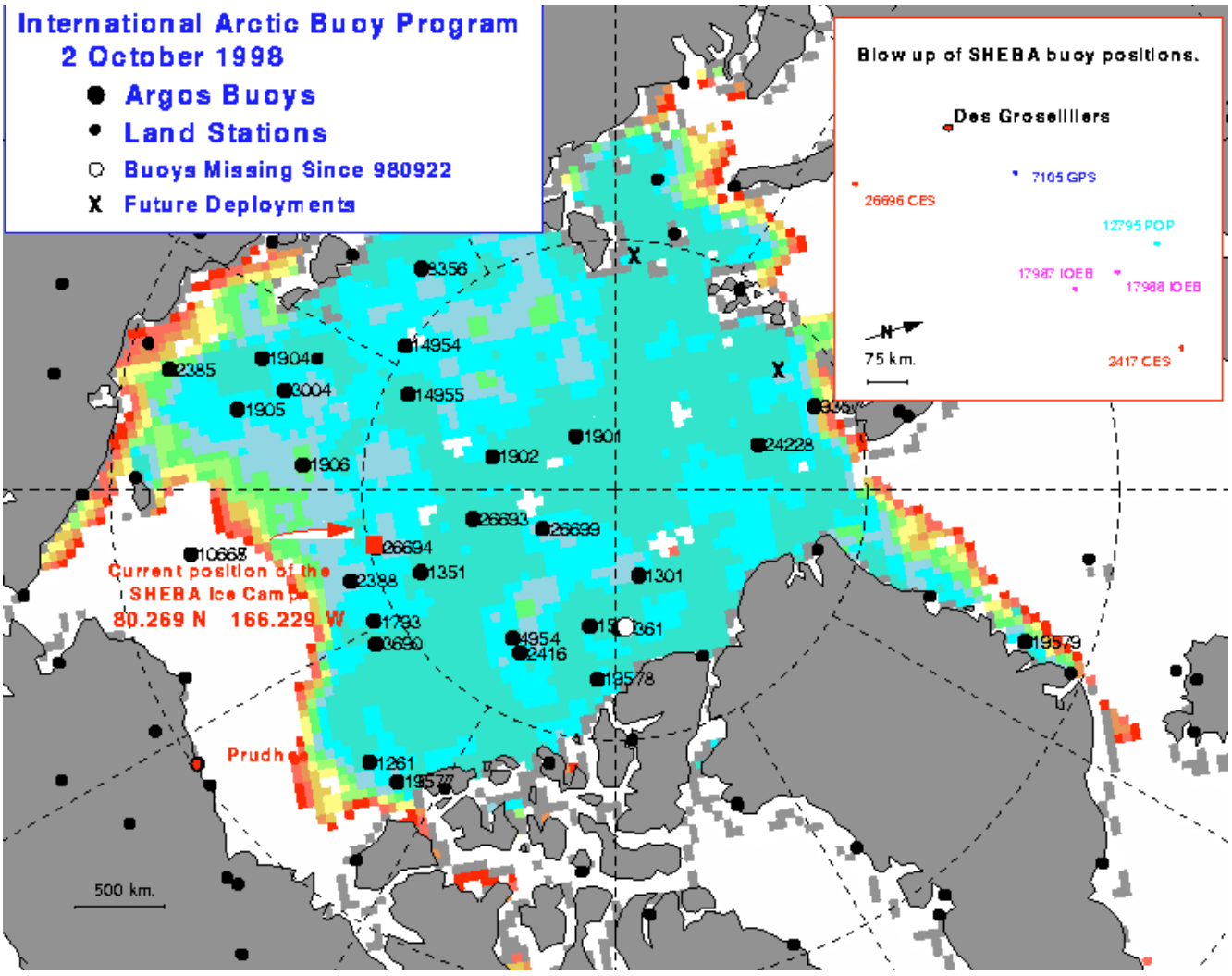

Figure 1. Buoy positions on October 2, 1998. A blow up of the buoy cluster near the SHEBA ice camp and the sea ice concentration analysis from NCEP are also shown.

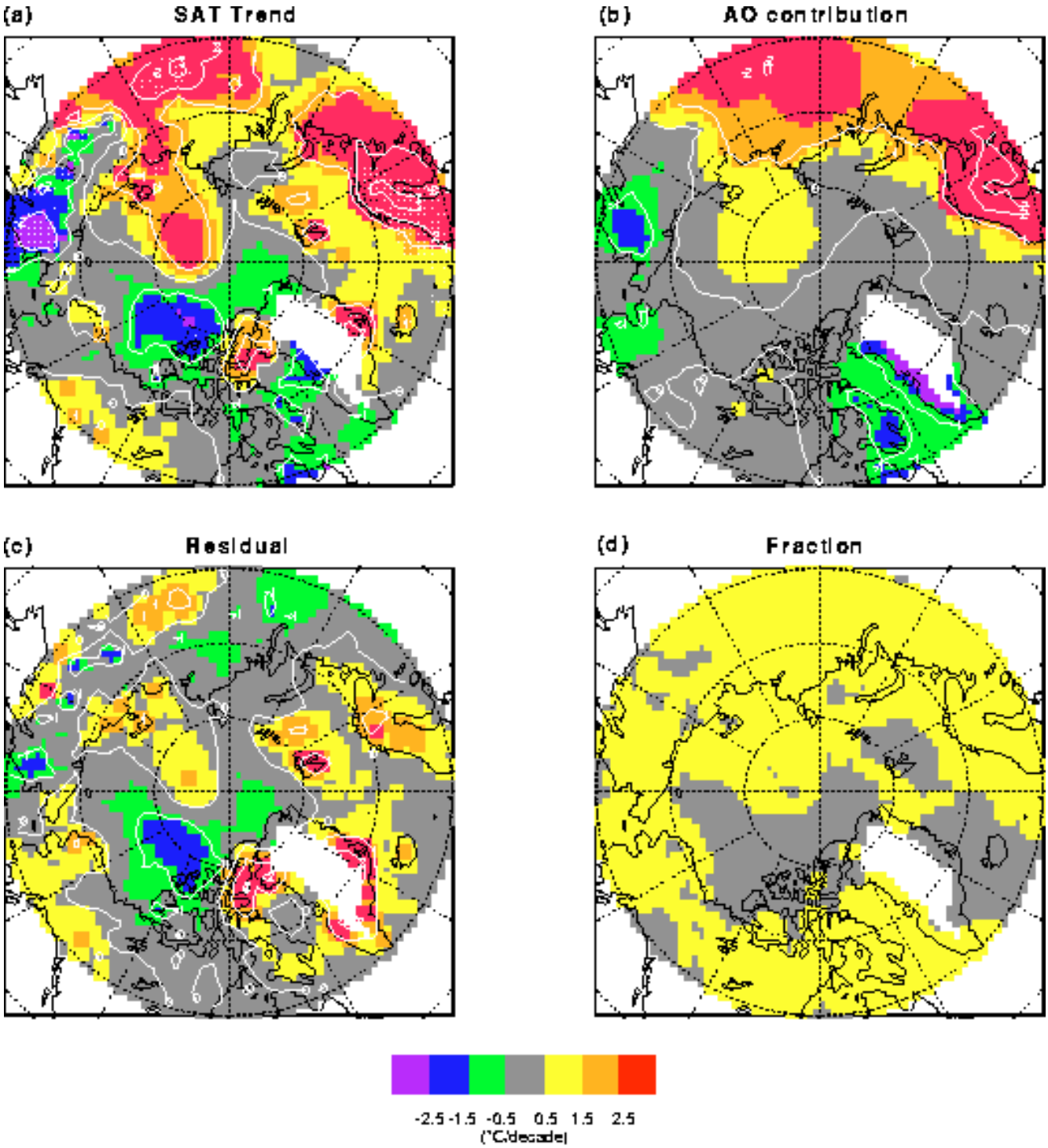

Figure 2. Contributions of Arctic Oscillation to Winter (December - February) SAT trends; (a) SAT trends; (b) AO contribution to SAT trends; (c) residual SAT trends not explained by AO; and (d) fraction of SAT trends explained by AO. The areas where the AO explains more than 50% of the SAT trend are shown in yellow, and the areas where the AO explains less than 50% of the SAT trend are shown in grey.